Agency Problem

Regulations Require Assessors to Consider the Impacts Pesticides have on Wildlife

- Threatened and endangered populations pose a critical management challenge
- WED is developing a model for exploring wildlife interactions with pesticides, changing landscapes, and other stressors

Project Goals

To Support OPP's Efforts to Address Impacts Pesticides have on Wildlife Populations

- Construction of the PATCH & HexSim models
- Publication of model applications
- Development of case studies with OPP
- Providing EFED with training on the model

Research Questions

How are Pesticides Altering Wildlife Population Viability

- How do wildlife populations respond to multiple interacting stressors?
- What impacts will pesticides have when other disturbances are also involved?
- What options exist for better managing pesticide impacts on T & E species?

Selected Impacts

- 30+ Publications based on PATCH / HexSim
- Willamette Alternative Futures Study
- Delivery of PATCH & HexSim to EFED
- Zoonitic Disease work under the ECO MYP
- Work on Ecosystem Services with WESP
- Wildlife Forecasting with CLAMS (USFS)
- Innovative Forest Practices Act study
- WA DFW Fisher Reintroduction Study
- Work on Ecosystem Services with WESP
- Wildlands Project Lynx & Marten Viability Study
- CBI 2008 Fisher Reintroduction Study
- NCEAS Connectivity Working Group
- NCEAS Great Basin Working Group
- SERDP Global Change & Stressor Interaction Study
- 2008 Norther Spotted Owl Recovery Plan
- Numerous Masters & Ph.D. Theses

Western Ecology Division
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ECOLOGICAL EFFECTS BRANCH

In a Nutshell:

PATCH is a spatially explicit, individual-based life history simulator designed to predict how the numbers and distribution of wildlife species will change over time.

The model can predict how wildlife populations will respond to multiple interacting stressors, how population density will increase or decrease, and whether the species is likely to go extinct. It can produce maps of where the species will be found as a landscape changes with time.

PATCH ("Program to Assist Tracking Critical Habitat") is a complex, spatially explicit computer model developed at WED by **Dr. Nathan Schumaker**. The model can address diverse questions using multiple datasets to introduce various factors into each simulation.

PATCH was designed to predict the potential effects of stressors such as pesticides, pollutants and land-use changes on ecosystems, and the long-term response of various species to such stressors.

For example, habitat types, weather conditions, food sources or disease events can be added or removed to determine the effect on a population. Simulations can be used to explore the efficacy of anticipated habitat recovery efforts.

Canadian researchers, led by Dr. Julie Heinrichs, recently sought input from Dr. Schumaker to assist them in predicting the fate of the "at-risk" Ord's Kangaroo Rat (*Dipodomys ordii*).

Ord's Kangaroo Rat was once abundant in Canada's arid sandhill region.

Seeing an opportunity to work with a dataset that could test and improve the model for EPA applications, Schumaker helped parameterize *PATCH* for this use by the Canadian research team.

Under Canada's Species at Risk Act (SARA), habitat that is critical to listed animals must be identified. Mapping such habitats requires integration of habitat availability and quality, as well as a population analysis that indicates the potential future "success" of the species.

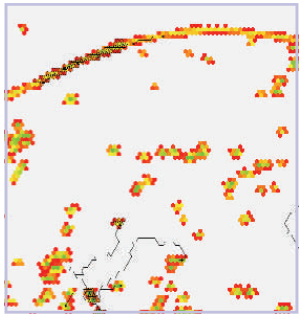
Ord's Kangaroo Rat is a nocturnal desert dweller whose energy requirement is met by a cheek-pouch load of seeds daily. It builds a complex underground burrow, and can survive for long periods without water.

This solitary animal requires an open, sparsely vegetated, sandy habitat.

Kangaroo Rats are important prey for many raptors, reptiles, and mammals, some of which are considered at risk in Alberta.

The goal of Heinrichs and her colleagues was to identify and assess habitats necessary for recovery and long-term persistence of Ord's Kangaroo Rat (K-Rat) using WED's spatially explicit population model.

While kangaroo rats in general are wide-spread in the U.S., Ord's Kangaroo Rat is listed as "at risk" in Canada's Alberta and Saskatchewan provinces due to loss of its arid sandhill habitat.



left: clusters of yellow and green hexagons represent high quality individual territories of Dipodomys ordii on this PATCH simulation map.

In the model, a simulated population of K-Rats was distributed throughout the landscape; location and movement of the individuals, and data on their overwintering, reproduction, and summer survival, were tracked through the landscape over a 50-year period. Schumaker set the model's parameters to assign habitat quality scores to pixels on a map, and then integrated them into a hexagonal grid.

PATCH may help predict what the future holds for K-Rat, and the results of this study will potentially be used as a benchmark for alternative management scenarios.

The use of WED's *PATCH* model by Canadian scientists demonstrates not only its versatility in a variety of applications, but also the value of EPA research to other nations and their agencies.

PATCH is currently utilized by EPA's Office of Pesticide Programs for ongoing research on the effects of pesticides in the environment.